

# Big Data & Data Analysis for e-Health

Muthu Dayalan

Senior software Developer & Researcher  
Chennai, Tamilnadu.

**Abstract-** Big data and data analysis for e-health are some of the emerging concepts in the information computer technology in the field of healthcare. Big data involves large amounts of data generated by the industry which is analyzed for meaningful use. The following paper focuses on the impacts big data and analysis has on various stakeholders in the healthcare field and the various applications. Additionally, the challenges that are present in the issue of big data have been outlined and how they negatively impact the big data and analysis application.

**Keywords:** Big data, healthcare, data analytics, e-health

## I. INTRODUCTION

All industries have been impacted by the big data and lots of changes have occurred in data is managed, analyzed and leveraged. Big data simply refers to extremely large sets of data that cannot be analyzed by the traditional data processing application [3]. They are analyzed systematically to be able to reveal trends, association and patterns in the industry. Big data analytics in the healthcare settings has enabled analyzing larges sets of data from millions of patients, helping to identify the correlation of the datasets and clusters and including development of predictive models. Bioinformatics, health and medical informatics, sensor informatics and medical imaging are some of elements compose of the big data analytics in the medical field [3]. Additionally, the medical field is receiving lots of data from insurers, research institutions, pharmaceutical industry and all other service providers that have a direct or indirect impact in healthcare.

E-health refers to the usage of information communication technology in the healthcare practice. Apart from the usage of electronic gadgets, it is described as health initiatives that use internet applications to deliver health data, information or services and other digital driven health initiatives [11]. e-health has contributed greatly to the big data issue to the better storage and retrieval of healthcare data, transmission and the development of analysis systems. The sources of data in the healthcare are mainly classified in structured data, semi-structured data and unstructured data. The structured data has a format and structure such as laboratory results or admission histories of a patient. The semi-structured data is organized with minimal structure such as data from sensors that monitor patients. Unstructured data contains no inherent structure and comes from a wide array of sources such clinical letters, medical prescriptions, and biomedical literature among others [12]. The advancement of the Electronic Health Records (EHR) has aided a lot in the development of big applications in the healthcare industry.

## II. IMPACTS OF BIG DATA ANALYSIS ON HEALTHCARE STAKEHOLDERS

### *Medical Practitioners*

Diagnosis processes and treatment plans of the patients generate massive amount of data that is shared across the industry. This type of data includes the clinical notes, laboratory tests and results, medical imaging data, classification

codes of clinical services and diseases, and the information from the sensor devices the capture data from patients' behaviors [10]. Big data analytics helps in analysis all this type data and help in developing Clinical Disease Repository (CDR) which offers quicker response through effectively analyzing patterns of diseases, and improving the public health surveillance [13]. The usage of the electronic gadgets in healthcare has also enabled the physicians track and monitor the conditions of a patient at any given time which a major stride in healthcare delivery.

### ***Pharmaceutical and Clinical Researchers***

Clinical researchers are employing big data analytics in classification the lots of information they are receiving from different fields develop better predictive models. These models are more effective in helping to understand biological processes as well as drugs which contributes to higher success rates in the drug designs [14]. The pharma companies are also able with the big data conduct effective trials with shorter periods. The using of computing technologies especially, has aided the pharmaceutical companies to develop automated systems that include drug manufacturing units to build end-to-end solutions to products through effective analysis and integration of various data sources. The input from other players in the field of health such physicians' recommendations of certain drugs, the consumption of drugs by the patients as well as the patient history easily reaches the pharmaceutical companies and well analyzed to help in establishment of strategic business solutions [6].

### ***Patients***

Today patients are using various devices and platforms to connect with others in various places in the world who are have similar diseases conditions, symptoms, side effects of drugs, and diagnosis among other medical-related issues they encounter. Such discussions among to massive amounts of data that big data analytics is applying to enrich the healthcare with relevant information. Patients are then able to benefit with better and more accurate diagnosis and treatment plans due to the use of this information and feedback [8]. The public health surveillance also uses this information from to identify the diseases patterns and assess the health of the populations. Telemedicine platform also provides a good platform for those who are not able to reach to hospitals to reach their healthcare needs. The platform also has the functions of a big data repository which is able to capture vital signs of diseases from a patients and connected with other systems to trigger health alerts [15].

### ***Health Insurers***

The health insurers are among those are reaping lots of benefits from bid data analytics. These organizations can advocate for better health plans for their clients based on the data collected of a patient and ailments for the benefits of both the insurer and the patient [6]. The issue of analyzing the unstructured data in an insurance claim helps identifying the authentic claims minimizing abuse. The application of big data and Internet-of-things (IOT) enables the insurers to come up with innovative models such as usage-based insurance, through analysis of the behavior of the client in real-time [10].

### ***Healthcare Facility Operators***

The owners and operators of health facilities rely on bid data analytics to optimize the available resources. The analytics give the operators the data on patient satisfaction and other related data that can help them improve the services they offer to their clients. Other issues involve of application of technological devices in healthcare such as telehealth and Mhealth.

### III. APPLICATION OF BIG DATA ANALYTICS

#### *Electronic Health Records*

This is one of the widespread applications of big data in healthcare where every patient has own digital records of their medical history, laboratory tests, and demographics among others. These records are shared using secure technological systems to both private and public institutions. The records are modifiable electronically which eliminates the use of paperwork. Big data analytics helps to analyze the records and trigger warnings as well as reminders on issues like new labs tests, and tracking subscriptions [1]. The EHR also aids the medical personnel in predicting the types of medication and tests based on the previous history and analysis of diseases patterns.

#### *Strategic Planning*

Governments, organizations and health facilities are using the results of big data analytics to draw their plans. The data provides insights on the disease conditions in a region and the behavior of the people in the area [9]. The knowledge of these issues that is important in helping organizations make concrete plans.

#### *Treatment and Research of Terminal Diseases*

Research on terminal illnesses such as cancer are using analysis of large amounts of data on the treatment and rates of recovery. The big data analytics is able to analyze the trends and treatments that show the highest rates of success. The researchers are able to follow close on the progress and behaviors of the diseases according to the data that is being provided [7]. The databases of patients suffering from a disease under investigation can be linked and their progress noted regarding their treatments and recovery which is crucial in providing insights on the steps to take.

#### *Enhance Security and Reduce Fraud*

The personal data is highly vulnerable to hackers and a breach in the electronic systems will lead into severe consequences. The big data analytics is being applied to monitor the network traffic. Changes in traffic in a manner that appears like a cyber-attacks lead to activation of security measures. On the other analytics are being used to streamline insurance claims and avoid repetition in the claims [7].

#### *Predictive Analytics*

Business intelligence trend has had lots of applications in the healthcare setting. The Optum Labs in US using EHR records of more than 30 million patients created a database that was used in predictive analytics [5]. The business intelligence in healthcare helps the physicians to make decisions that are supported by data with short periods of time. The tool improves the patient treatment by taking consideration of the previous treatment histories and similar outcomes of patients with similar conditions.

#### *Enhancing Patient Engagement*

With the influx of smart devices today, many people have taken the advantage of using them to monitor their health conditions which can be compared to their health records and other data from various sources predict the possible disease lurking. Some of the issues that are tracked by these devices include, sleeping habits, heart rates, temperature among others [5]. The patients can therefore be involved in monitoring their own health issues and also help the insurance agencies offer incentives that can lead to healthy lifestyles.

### ***Real-time Alerts***

The Clinical Decision Support (CDS) software in healthcare facility use big data analytics to analyze medical data and provide advice the healthcare professionals on clinical decisions. Today, data collected from patients through wearable devices and stored in the clouds where analytics are applied to offer prescriptions to the patient.

## **IV. CHALLENGES IN BIG DATA ANALYSIS**

### ***Capturing the Correct Data***

Data analytics is driven by accurate, clean and complete data. However, in some cases, the data that is captured fails to meet the right standards which leads to misleading analysis.

### ***Storage issues***

The growing volume of medical data leads to higher demands of storage space. Many organizations prefer on premise data storage to ensure is safe, accessible and up-time built the growing data leads to increase in the costs [1]. However, the growing reliability of the cloud options, many organizations are then preferring the use of cloud data storage which lowers costs and enhances security.

### ***Data Security***

The security of data is one of the high prioritized issues in data analytics. The major threats to data security involves hackings, breaches, and ransomware. The HIPAA contains various safeguards of data for organizations that are storing or using protected health information [2]. Though, there are various security procedures and regulations there has been cases of human error leading to breach of private data.

### ***Data Cleaning***

Clean data in accurate, relevant, consistent, and not corrupted. If the data is not clean it possible to derail projects of big data analytics [4]. There are usually manual methods of cleaning data which makes the process slow and tedious.

### ***Data Volatility***

Health issues are very dynamic and the data stored need to be kept updated and relevant. Data that is not frequently updated is likely to be inconsistent and lead to wrong conclusions which may endanger the life of an individual [4].

### ***Data management Challenges***

To enable proper utilization of big data and the opportunities it provides, healthcare organizations need the services of data scientist. Additionally, the information technology hardware and software may not be able to handle the different data formats [2]. These issues lead to additional costs which struggling health organizations may not afford.

## **V. CONCLUSION**

To summit it all, e-health and big data analysis are very important concepts in the healthcare settings today. Government and private agencies need to develop their infrastructure to handle the big data and analysis. All the stakeholders in the healthcare industry are all impacted by the big data issue and needs to be prepared for more involvement in future. There are widespread applications of big data analysis and e-health with a lot of benefits. However, challenges that exist in the big data such as security, capture, storage and cleaning among others.

## REFERENCES

- [1] Adibuzzaman, M., DeLaurentis, P., Hill, J., & Benneyworth, B. D. (2017). Big data in healthcare—the promises, challenges and opportunities from a research perspective: A case study with a model database. In *AMIA Annual Symposium Proceedings* (Vol. 2017, p. 384). American Medical Informatics Association.
- [2] Agarwal, R., & Dhar, V. (2014). Big data, data science, and analytics: The opportunity and challenge for IS research.
- [3] Belle, A., Thiagarajan, R., Soroushmehr, S. M., Navidi, F., Beard, D. A., & Najarian, K. (2015). Big data analytics in healthcare. *BioMed research international*, 2015.
- [4] Bresnick, J. (2019, June 19). Top 10 Challenges of Big Data Analytics in Healthcare. Retrieved from <https://healthitanalytics.com/news/top-10-challenges-of-big-data-analytics-in-healthcare>
- [5] Big Data in Healthcare: Challenges & Promise. (2019, April 17). Retrieved from <https://catalyst.nejm.org/big-data-healthcare/>
- [6] Lebid, M. (2019, January 4). 12 Examples of Big Data In Healthcare That Can Save People. Retrieved from <https://www.datapine.com/blog/big-data-examples-in-healthcare/>
- [7] Nambiar, R., Bhardwaj, R., Sethi, A., & Vargheese, R. (2013, October). A look at challenges and opportunities of big data analytics in healthcare. In *2013 IEEE international conference on Big Data* (pp. 17-22). IEEE.
- [8] Martin-Sanchez, F., & Verspoor, K. (2014). Big data in medicine is driving big changes. *Yearbook of medical informatics*, 23(01), 14-20.
- [9] Palanisamy, V., & Thirunavukarasu, R. (2017). Implications of big data analytics in developing healthcare frameworks—A review. *Journal of King Saud University-Computer and Information Sciences*.
- [10] Sun, J., & Reddy, C. K. (2013, August). Big data analytics for healthcare. In *Proceedings of the 19th ACM SIGKDD international conference on Knowledge discovery and data mining* (pp. 1525-1525). ACM.
- [11] Tachakra, S., Wang, X. H., Istepanian, R. S., & Song, Y. H. (2003). Mobile e-health: the unwired evolution of telemedicine. *Telemedicine Journal and E-health*, 9(3), 247-257.
- [12] Viceconti, M., Hunter, P., & Hose, R. (2015). Big data, big knowledge: big data for personalized healthcare. *IEEE journal of biomedical and health informatics*, 19(4), 1209-1215.
- [13] 7 Ways Data Science Is Reshaping Healthcare. (n.d.). Retrieved from <https://www.altexsoft.com/blog/datascience/7-ways-data-science-is-reshaping-healthcare/>
- [14] Wang, Y., Kung, L., & Byrd, T. A. (2018). Big data analytics: Understanding its capabilities and potential benefits for healthcare organizations. *Technological Forecasting and Social Change*, 126, 3-13.
- [15] Wilson, E. V., & Lankton, N. K. (2004). Modeling patients' acceptance of provider-delivered e-health. *Journal of the American Medical Informatics Association*, 11(4), 241-248.